Claims

1. A constellation design for a communication system, comprising :

a plurality of rings in a constellation, wherein each ring in the plurality of rings has a different radius that is dependent upon a total number of points in the constellation design;

a phase difference between two consecutive points on a predetermined ring dependent upon an order of the predetermined ring;

a predetermined number of rings dependent upon the total number of points in the constellation design; and

a predetermined bit sequence assignment to the points in the constellation design dependent upon the total number of points in the constellation design.

2. The design according to claim 1, wherein when the total number of points is 8, the structure comprises 2 rings having a first order ring with a radius of 1 and a second order ring of a radius of 2, a phase difference between two consecutive points of 90 degrees on both the first order ring and the second order ring, and a bit order sequence of 000, 001, 011, and 010 on the first order ring and a bit order sequence of 100, 101, 111, and 110 on the second order ring..

3. The design according to claim 1, wherein when total number of points is 16, the structure comprises 3 rings having a first order ring with a radius of 1, a second order ring of a radius of 1.5, and a third order ring with a radius of 2.3, a phase difference between two consecutive points of 90 degrees on both the first order ring and the second order ring and a phase difference between two consecutive points of 45 degrees on the third order ring.

4. The design according to claim 1, wherein when total number of points is 32, the structure comprises 4 rings having a first order ring with a radius of 1, a second order ring of a radius of 1.2, a third order ring with a radius of 1.4, and a fourth order ring with a

radius of 1.9, a phase difference between two consecutive points of 90 degrees on both the first order ring and the second order ring, a phase difference between two consecutive points of 45 degrees on the third order ring, and a phase difference between two consecutive points of 22.5 degrees on the fourth order ring.

5. The design according to claim 1, wherein when total number of points is 64, the structure comprises 5 rings having a first order ring with a radius of 1, a second order ring of a radius of 1.12, a third order ring with a radius of 1.47, a fourth order ring with a radius of 2.12, and a fifth order ring with a radius of 2.8, a phase difference between two consecutive points of 90 degrees on both the first order ring and the second order ring, a phase difference between two consecutive points of 22.5 degrees on the third, fourth and fifth order rings respectively.

6. The design of claim 1, wherein modulation using the design is for a semi-non-coherent system and wherein a modulated symbol has:

a same magnitude as one of the points mapped with an incoming bit sequence; and

a differentially encoded phase with one of the points mapped with the incoming bit sequence and with one of the points mapped with a previous modulated symbol.

7. The design according to claim 6, wherein the phase of a first data symbol is differentially encoded with a reference symbol which lacks data information but is known at both a receiver and a transmitter of the design.

8. The design of claim 7, wherein the reference symbol is a last symbol in a preamble.

9. A design according to claim 1, wherein the design is a communication system having a channel subject to a sudden phase change and wherein a modulated symbol has a phase encoded differentially with the phase of a previous modulated symbol and an absolute magnitude.

10. The design according to claim 9, wherein the communication system is a power line communication system.

11. The design of claim 1, wherein modulation using the design is for a coherent system and wherein a modulated symbol has:

a same magnitude as one of the points mapped with incoming bit sequence; and

a same phase with one of the points mapped with incoming bit sequence.

12. A method for demodulation in a semi-non-coherent system, the method comprising the steps of:

estimating a magnitude for a current received symbol;

differentially decoding a phase with a phase of a previous received symbol for a phase of the current received symbol; and

finding a closest point to the current received symbol with the differentially decoded phase and the estimated magnitude on a predetermined constellation.

13. The method according to claim 12, wherein the method further comprises the step of demodulating a first data symbol with a reference symbol which is a last symbol in a preamble and is known at both a receiver and a transmitter in the system.

14. A method for demodulation a coherent system, the method comprising the steps of:

estimating a magnitude for a current received symbol;

estimating a phase for a current received symbol; and

finding a closest point to the current received symbol with the estimated phase and the estimated magnitude on a predetermined constellation.

15. A communication system, comprising:

a receiver having a combined orthogonal frequency division multiplexing demodulation and a bit-interleaved coding demodulation scheme;

a transmitter having a combined orthogonal frequency division multiplexing modulation and a bit-interleaved coding modulation scheme; and

a bitmap shared by the receiver and the transmitter providing a predetermined constellation of symbols wherein an amplitude and a differentially encoded phase are used to determine a closest symbol for a currently transmitted symbol.

16. The communication system of claim 15, wherein the bitmap comprises different number of sample points are positioned on different rings and the points on a same ring have a same phase difference, while the phases of points on two consecutive rings are different.

17. The communication system of claim 15, wherein a phase is differentially encoded with a previous encoded symbol, but an amplitude is not.

18. The communication system of claim 17, wherein a channel gain estimation is used to determine the amplitude.